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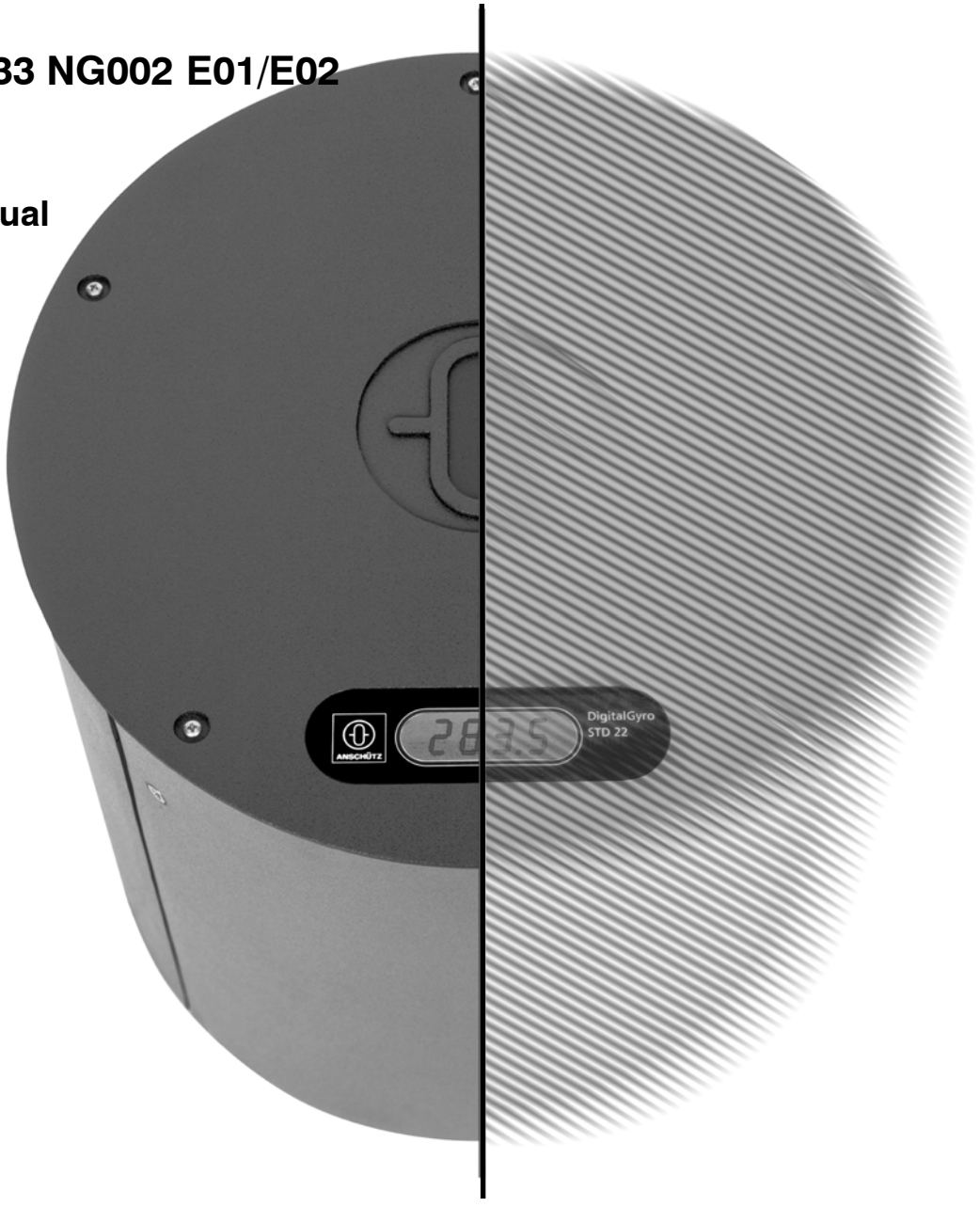
Standard 22 Compact GYRO COMPASS and Standard 22 GYRO COMPASS

Type 110 -233 NG002 E01/E02

Operator manual



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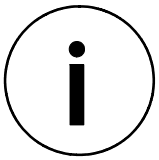
The above mentioned standards require a new alert philosophy called “Bridge Alert Management”. The Standard 22 gyro compass is compliant to such standards in combination with Operator Unit Gyro, type 130-626.NG00x. Please refer to the manuals of Operator Unit Gyro, type 130-626.NG00x for any details about the alert handling and presentation. For new installations it is recommended to make use of new alert management.

Alert outputs must be connected to a central Alert Panel/ Signal Unit.
Alert Panels or Signal, Units must have an acoustical and optical alert indication. Make sure that alerts are presented at the conning position.

Maintenance and repair work or any other work performed on the gyro compass should be carried out only by trained and qualified staff who are well versed in national safety regulations.
After the gyro compass has been switched off it is necessary to wait at least 15 minutes before accessing the interior of the gyro compass. Otherwise the sphere could be damaged!



A flashing decimal point in the seven segment display indicates an operating condition where the operation of the gyro equipment is not restricted. The operating condition needs to be checked. Call an authorized service station if required.
Refer to chapter 3 for further details

Please note that all ships of 500 Gross tonnage and upwards according to SOLAS regulations must be with a gyro compass. The Gyro compass must be operational. For this reason it is not allowed to have a switched-off gyro compass during voyages. A switched-off gyro compass during voyages could damage to the Gyrosphere.

There is a reduced accuracy of the compass during the settling stage.
The compass shows required accuracy after ending of the settling stage (appr. 4 hours after switching ON).

It is strongly recommended to observe (to read) all manuals within a Compass STD 22 application.

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Operator Manual
Compass Standard 22
and
Standard 22 Compact

1 General

This compass is designed for use as a navigation aid on board ships.

As a sensor, and unaffected by the magnetic earth field, it determines the north bearing, and thus enables a heading to be steered in relation to true north.
This compass provides heading information and status signals to those responsible for heading setting.

In principle we can distinguish between two different applications for the compass:
The **STD22 Compact Compass** as a stand-alone system

and

The **STD 22 Compass** used in conjunction with other system components.
An Operator Unit and a Distribution Unit are required to connect and to operate other system components.

The overview on the next page illustrates the functional differences between these two versions.

Operator Manual
Compass Standard 22
and
Standard 22 Compact

STD 22 Compact as a stand-alone system	STD 22 with other system components (Distribution Unit NG002/003 and Operator Unit)
Inputs: - GPS positioning data - Speed data from the GPS - Speed from the Pulse Log - Direction of speed from the Pulse Log - NMEA - 24V d.c. voltage supply	**Inputs (via the Distribution Unit only through a "CAN bus" data bus system):** - GPS positioning data - Speed data from the GPS - Speed from the Pulse Log - Leading sign for the speed from the Pulse Log - NMEA - 24V d.c. voltage supply - DV-bus (alternative inputs for speed/position at the Distribution Unit Optional feature: - Other (non Raytheon Anschütz) heading sensors can be connected to the Distribution Unit
Outputs: - 2 x Heading (course bus or NMEA) designated CHn 1 and CHn 2 - 1 x Heading (course bus) - Status signals SEC (speed error correction) System Available Optional feature Additional Output Box 146-103 Input: - 1 x Heading (course bus) Outputs: SSC-Interface Step (6 steps/degree) NMEA superfast 50Hz	**Outputs (at STD 22 compass):** - 2 x Heading (course bus or NMEA) - 1 x Heading (course bus) - Status signals SEC(speed error correction) System Available ⚠ Heading (Course bus or NMEA) without SEC **Outputs (Distribution Unit NG002/003):** - 1x RS232 for courseprinter - 1x rate of turn (analog) - 12 x Heading (course bus or NMEA) - DV-bus - Status signals
Functions: - Integral Speed Error Correction (SEC) Optional feature - Quick Settling with the Operator Unit for Quick Settling	**Functions: (Compass STD 22)** - Integral Speed Error Correction (SEC) - Quick Settling via the operator unit

1.1 STD 22 Compact Gyro Compass

The position and speed (GPS and Pulse Log) are supplied to the compass as input data. Both types of data are required for the automatic Speed Error Correction function.
To activate this function the QS Operator Unit can be connected to the gyro compass as an option.

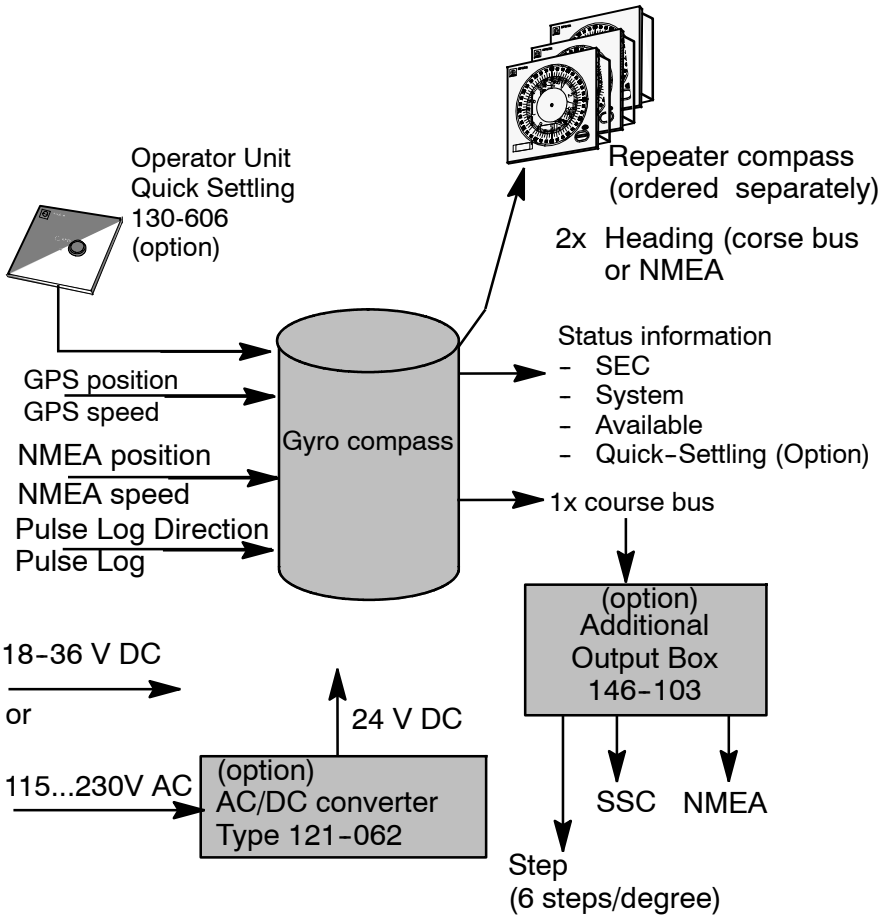


Figure 1 : STD 22 Compact Gyro Compass

Speed Error Correction (SEC)

This function automatically corrects the latitude error of the gyrosphere error in the gyro compass. The gyro compass receives the data required to make the correction, such as the speed and latitude, from GPS receivers, NMEA resp. from the Pulse Log.

Quick Settling operator unit (Option)
This function can be used to reduce the time between switching on the compass and indicating (outputting) a valid heading value to one hour (with a precision of +/-3°).
In the STD 22 Compact this function is activated from the
QS Operator Unit (130-606 NG001); in the STD22 this function is activated from the Operator Unit (130-626).

The **Compact** STD 22 gyro compass consists of
- the 110-233 NG002 gyro compass
- the 111-006 gyrosphere

Optional features:
- QS Operator Unit, 130 - 606
- AC/DC converter, 121-062
- Additional Output Box,146-103

The Speed Error Correction function is available only when a GPS or Pulse Log is connected.

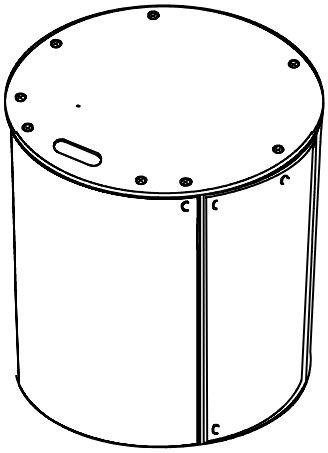
The output interfaces on the STD 22 Compact are as follows:
- Heading (corrected - SEC) as NMEA or course bus
- Status signals (alerts, error messages)

Optional via the Additional Output Box box:
- NMEA superfast (50Hz)
- Step (6 steps/degree)
- SSC

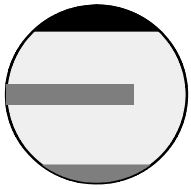
The input interfaces on the STD 22 Compact are as follows:
- NMEA Position
- NMEA Speed
- Pulse Log Direction
- Pulse Log

} Status signals or pulses

1.1.1 STD 22 Compact Gyro Compass – Scope of Supply



Gyro compass with outer sphere, distilled water and supporting liquid



Gyrosphere
packed separately

- Tool and spare parts pack
- User and service manual

Figure 2 : STD 22 Compact Gyro Compass – Scope of Supply

1.1.2 STD 22 Compact Gyro Compass optional features

1.1.2.1 Quick Settling operator unit

The “Quick Settling” function reduces the time the compass requires to settle to approximately one hour.
The most recent heading is stored when the gyro compass is switched off. When it is switched on the compass uses that value to make a default setting so that the settling time is reduced.

The Quick Settling function can only be used if the ship‘s heading has **not** been changed between switching off and switching back on.
The Quick Settling function can **not** be used:

- During the first setting up (installation).
- If the ship‘s position was changed between switching off and on again of the compass.
- If the temperature of the gyro supporting liquid is more than 30°C.

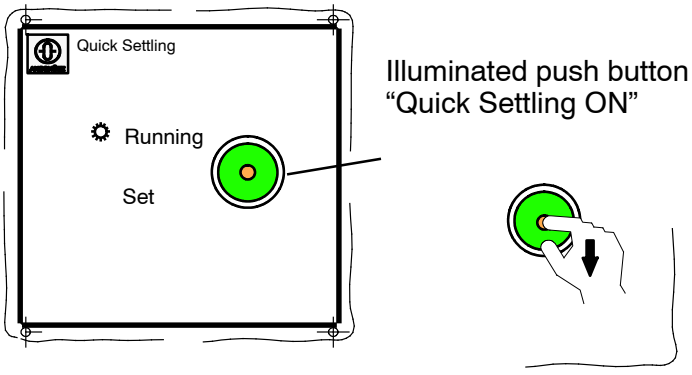


Figure 3 : Controls and indicators on the Quick Settling Control Unit

The “Quick Settling ON” button → activates this function.
→ Flashes if it is possible to activate this function.
It flashes for maximum 3 minutes.
→ Illuminates if the Quick Settling function is active.

Installation and assembly instructions are in the Service section of this manual.

1.1.2.2 AC/DC converter, 121-062

The AC/DC converter is supplied with 115 to 230 V AC on the input side, and delivers 24 V DC as output voltage with a maximum output power of 240 W (see separate manual no. 4175).

Figure 4 : AC/DC Converter 121-062

1.1.2.3 Additional Output Box 146-103

(not illustrated)
This connection box is used to convert the serial course bus into a Fast NMEA data format.
The connection box is connected to the 24 V d.c. power supply.

1.2 STD 22 Gyro Compass

In this application the gyro compass is operated on a bus system (CAN bus). With this application there are more extended options for connecting external equipment, and considerably more heading receivers can be operated.
This application needs to be equipped with a minimum of a type 130-626 Operator Unit and a type 138-118 NG002/003 Distribution Unit.
A magnetic sonde can be connected directly to the Distribution Unit.

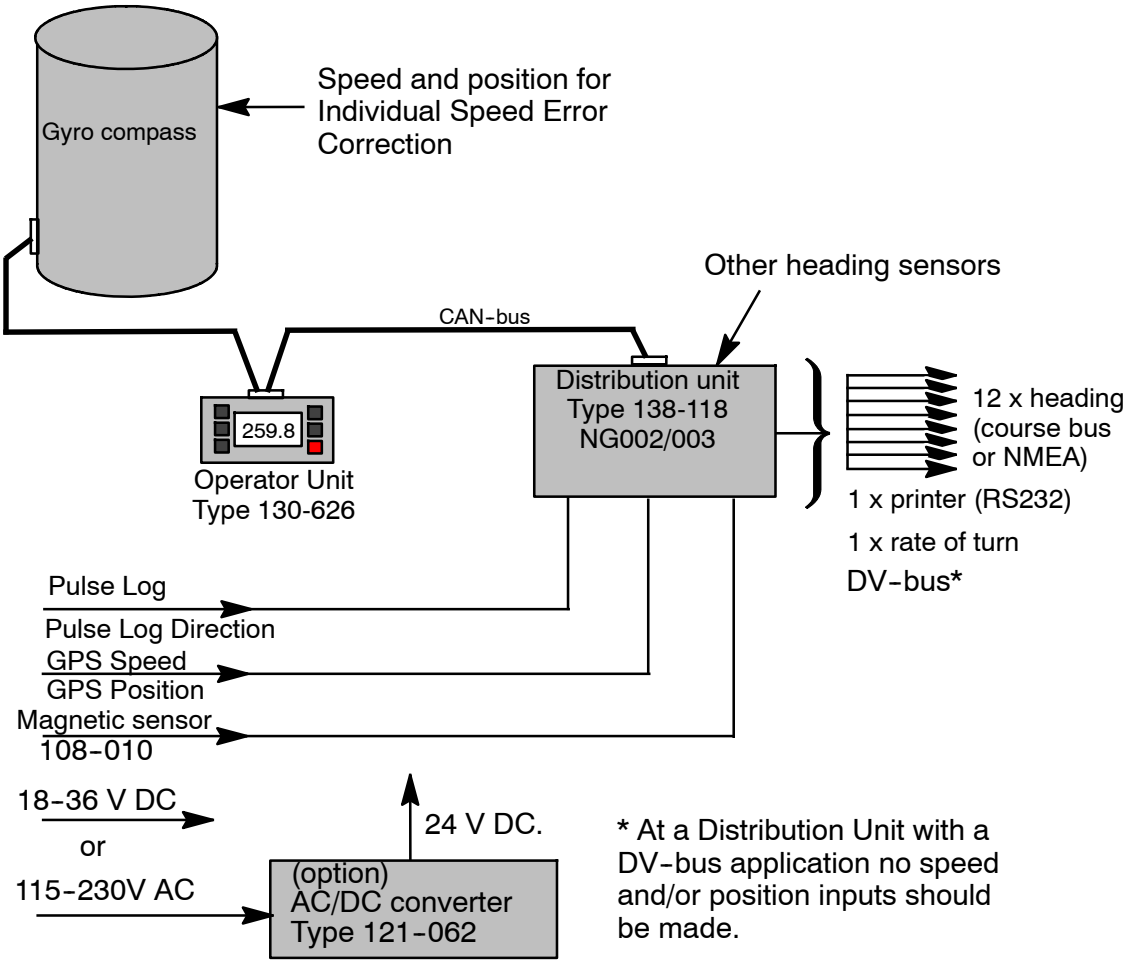


Figure 5 : STD 22 gyro compass

Some other possible applications are shown in drawings
(appended at the Service Manual of this Compass STD 22 NG002).

The STD 22 gyro compass consists of
- the 110-233 NG002 gyro compass
- Operator Unit, 130-626
- Distribution Unit, 138-118 NG002/003

Optional features:
- AC/DC converter, 121-062
- Gateway to an Autopilot

The output interfaces on the STD 22 are as follows:
- Heading (corrected - SEC) as NMEA or course bus
- Data bus (CAN-Bus)
- Status signals (alerts, error messages)
- RS 232 for heading and rudder position printer connection
- Rate of turn
- DV-bus

The input interfaces on the STD 22 are as follows:
- NMEA Position
- NMEA Speed
- Pulse Log Direction
- Pulse Log

} Status signals or pulses

Optional features (via a connected Distribution Unit):
Magnetic sonde (Raytheon Anschuetz probe, type108-010)
FLUXGATE compass
MINS
Satellite Compass
and other non Raytheon Anschuetz heading sensors

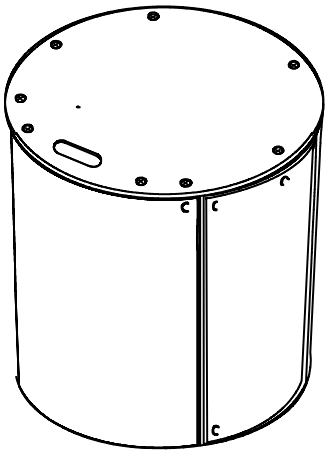
Voltage is supplied to the gyro compass via the Distribution Unit or is directly connected to the compass itself.

There are separate manuals for the Operator Unit and for the Distribution Unit.

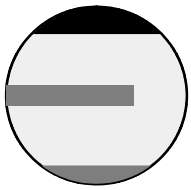
The Quick Settling function is activated via the Operator Unit.

The automatic Speed Error Correction function is available only when a GPS (NMEA speed and NMEA position) or Pulse Log and a NMEA position is connected. The relevant data must be supplied via the Distribution Unit.
Manual Speed Error Correction (SEC) is applicable by manual input of speed and position at an Operator Unit.

1.2.1 STD 22 Gyro Compass – Scope of Supply



Gyro compass with outer sphere, distilled water and supporting liquid



Gyrosphere
packed separately

- Tool and spare parts pack
- Operator and Service manual

Operator Unit 130-626
with manual

Distribution Unit 138-118
NG002/003
with manual

Figure 6 : STD 22 Gyro Compass – Scope of Supply

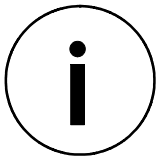
1.2.2 Optional features for the STD 22 Gyro Compass

1.2.2.1 AC/DC converter, 121-062

The AC/DC converter is supplied with 115 to 230 V AC on the input side, and delivers 24 V DC as output voltage with a maximum output power of 240 W (see separate manual no. 4175).

Figure 7 : AC/DC Converter 121-062

1.3 Technical data



The technical data stated here apply equally to the STD 22 Compact Gyro Compass and the STD 22 Gyro Compass

1.3.1 Mechanical data

Gyro compass, see dimensional drawing 110 D 233 HP005

1.3.2 Electrical data

Gyro compass

Supply voltage:	18–36 V DC
Current consumption:	max. 140W (heating stage)
	max. 80W (operation)

1.3.3 General Technical Data

"Quick Settling" function

Reduces the settling in phase to approximately 1 hour.
Quick Settling should only be used when the heading of the vessel has not been changed during the period between switching off the compass and switching it back on and if the compass has been switched off for a duration of min. 1 hour before.

Speed Error Correction

Automatic correction of a heading, related to speed and degree of latitude
(see also section 2.2)

Pulse log input (200 Pulses/Nm)
Pulse log - Direction - input (+) → "Speed ahead"
(–) → "Speed astern"
or "reverse speed" status
GPS input (NMEA according to IEC 61162-1)
Log input (NMEA according to IEC 61162-1)

Indicator precision

4 digit digital display
Resolution 0.1°

Heading accuracy

Settle point error: ± 0.1° x secLAT., RMS
Static error: ± 0.1° x secLAT., RMS
Dynamic error ± 0.4° x secLAT., RMS
(periodic roll and pitch + horizontal acceleration)
secLat. = 1/cosLatitude

Follow up up to 100° /sec

2 Controls and Indicators on the Gyro Compass

The user information stated here applies equally to the STD 22 Compact Gyro Compass and the STD 22 Gyro Compass.

Viewed from above (see Figure 8)

- Digital indication of the following:
  Compass heading
  Operating status
  Operating conditions requiring attention
  Error messages

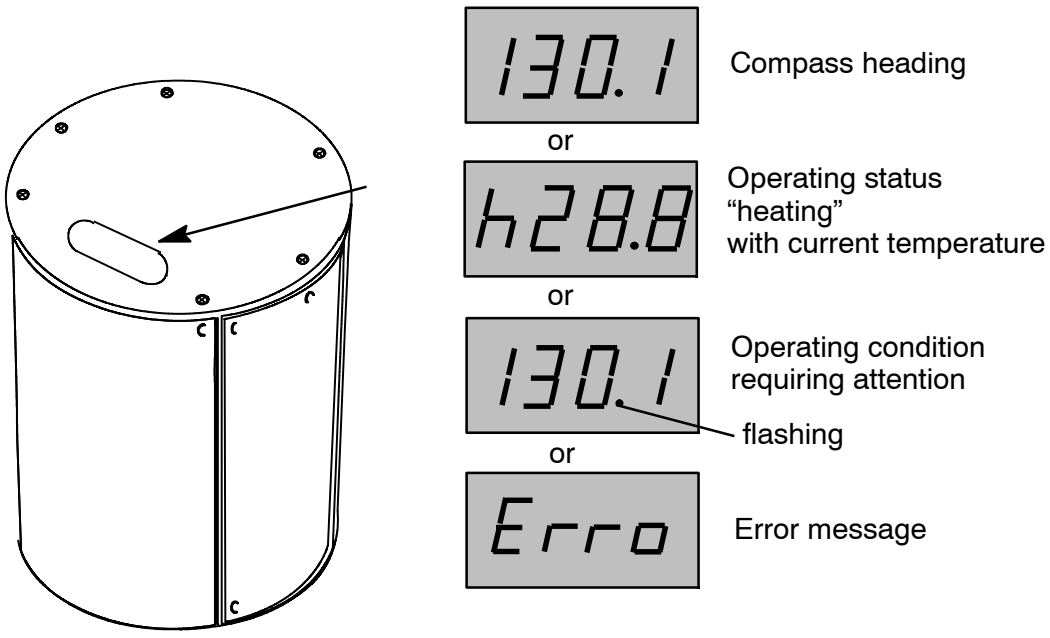


Figure 8 : The indicators on the gyro compass with examples of the type of indication

After removing the cover:

Do not touch live parts.
Neither the DIP switches nor the buttons are live.

A DIP switch (B37) and two push-buttons (B38 and B39) are used to adjust the settings as follows:

- Heading and correction data
- Settings for functional checks
- System settings such as data formats or transmission speeds.

Only authorised personnel are authorised to change system settings!!

Please observe the relevant instructions in the service manual.

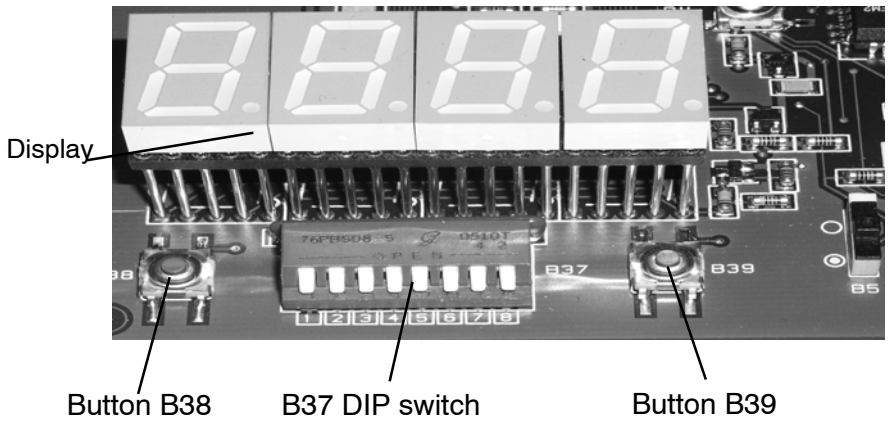


Figure 9 : Operating elements on the compass (after removing the cover)

2.1 Switching on the STD 22 Compass

The compass goes into operation when the power supply is switched on from the ship's mains.

The compass goes into the heating stage for the first 30 minutes (this period will vary depending on the temperature of the supporting liquid) and the letter "h" is displayed as the leading sign on the digital display. The follow-up system is switched off – no heading can be output.

When the temperature of the supporting liquid reaches 45 °C the follow-up system switches on automatically, and the heading is displayed on the compass; **however deviation from actual heading may still be considerable.**

This settling phase (indicated by an additional dot on the digital display) ends 4 hours after switching on. Accuracy is now < 2°.

No NMEA Heading and NMEA RoT is displayed (output) during the settling stage.

After about five hours (from switching on) the compass shows an accurate heading (see Technical Data, section 1.3.3).

The "Quick Settling" option reduces the settling in phase to one hour. With it, precision (after one hour) is better than +/–3°.

The "Quick Settling function can be performed either with an Operator Unit, type 130–606 or via a Distribution Unit with an Operator Unit, type 130–626.

The Quick Settling function can only be used if the ship's heading has **not** been changed between switching off and switching back on.

The Quick Settling function can **not** be used:

- During the first setting up (installation).
- If the ship's position was changed between switching off and on again of the compass.
- If the temperature of the gyro supporting liquid is more than 30°C.

2.1.1 Indications on the compass during the heating stage

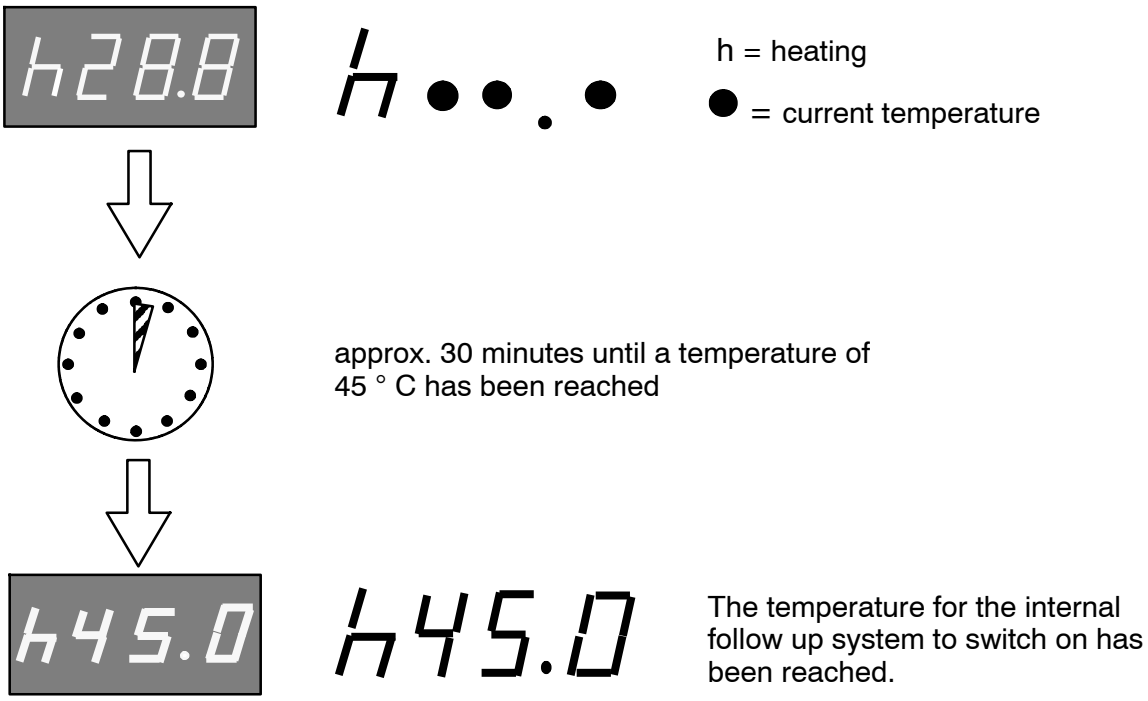
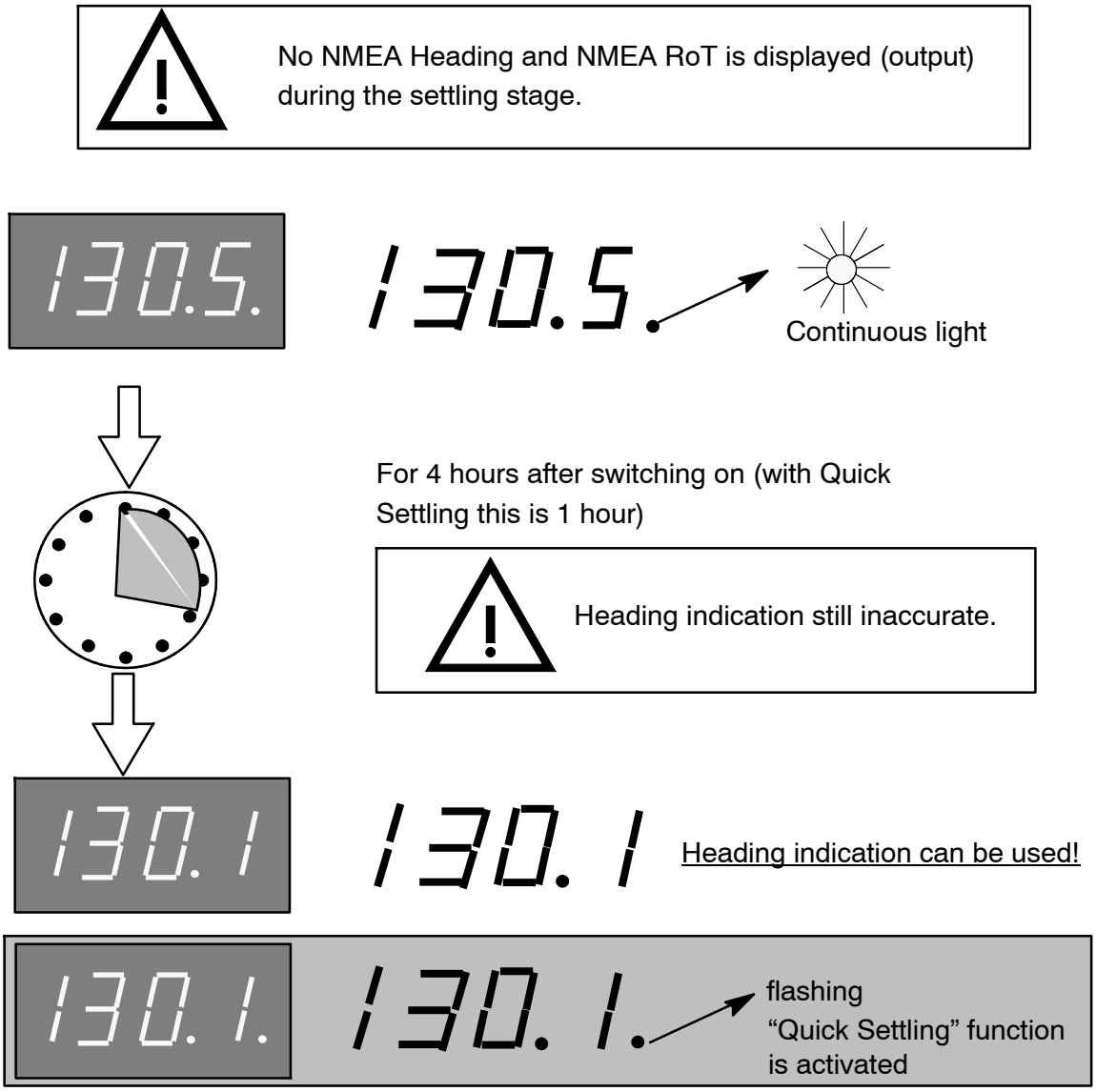


Figure 10 : Indications during the heating stage

2.1.2 Indications on the compass during the settling stage



Note: If the Quick settling function is activated, the heading to which it will followed-up is displayed.

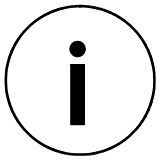
Figure 11 : Indications during the settling stage

2.1.3 Overview of indications (digital display) during operation

Once the compass is switched on the digital display indicates as follows:

Indications	Comments, Information
1 Heating stage	
Example	The temperature of the supporting liquid is displayed during the heating stage. Example: ***h 28.8*** = 28.8 °C heating stage
2 Settling stage	
Example lit up	The gyro compass is settling in. – The heading is indicated with an illuminated dot after the last figure during the settling stage (approx. 4 hours) The heading value is still not accurate!
3 Heading indication	
Example	Once the settling process has ended: Heading accuracy: – 4 hours after switching on is better than 2° or – with Quick-Settling 1 hour after switching on is better than 3° – Approximately 5 hours after switching on 0.4° dynamic, 0.1° static

2.2 Heading correction



The information given here, in particular with regard to Speed Error Correction, applies in general to the STD 22 Compact compass and the STD 22 compass. Where there is an exception, your attention is drawn to this.

The heading has to be corrected::

- a correction depending on the alignment error
- a correction depending on a speed error

2.2.1 Alignment error

The **alignment error** (A-error) occurs if the compass was not correctly aligned when it was installed, i.e. when the compass zero line does not agree with the ship's–line pre-alignment. An alignment error can be corrected at max. 5 h after switching on and/or max. 5 h when the ship is moored by making readjustments (see also service manual).

To try to perform a readjustment within this 5 hours, will lead to a displayed message “AL.no” after pressing the button B38 or B39 (it means: actually no readjustment possible).

2.2.1.1 Procedure for setting the compass zero (A-error)

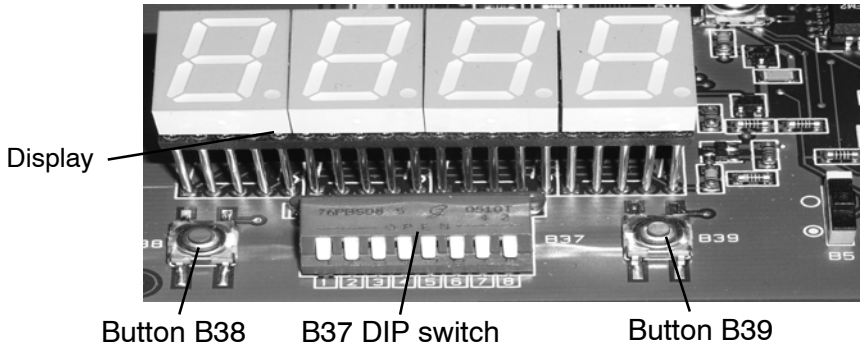


Figure 12 : Arrangement of operating elements inside the compass

1.) Remove the cover of the compass (unfasten the 5 cross-slotted screws)

2.) Move switch B37 (DIP switch), contact (1) to the “OPEN” position.

3.) The digital indicator is now indicating “ALEr” = Alignment Error

4.) Press button B38 or B39 until the heading you require displays.

As you do so the heading value changes (B38 changes the value downwards and B39 changes it upwards).

If you hold down the button the speed at which it changes will increase.

NOTE: If the message “AL.no” is displayed, then the a. m. restriction of 5 hours is not over.

5.) Move switch B37 (DIP switch), contact (1) back to the “OFF” position.

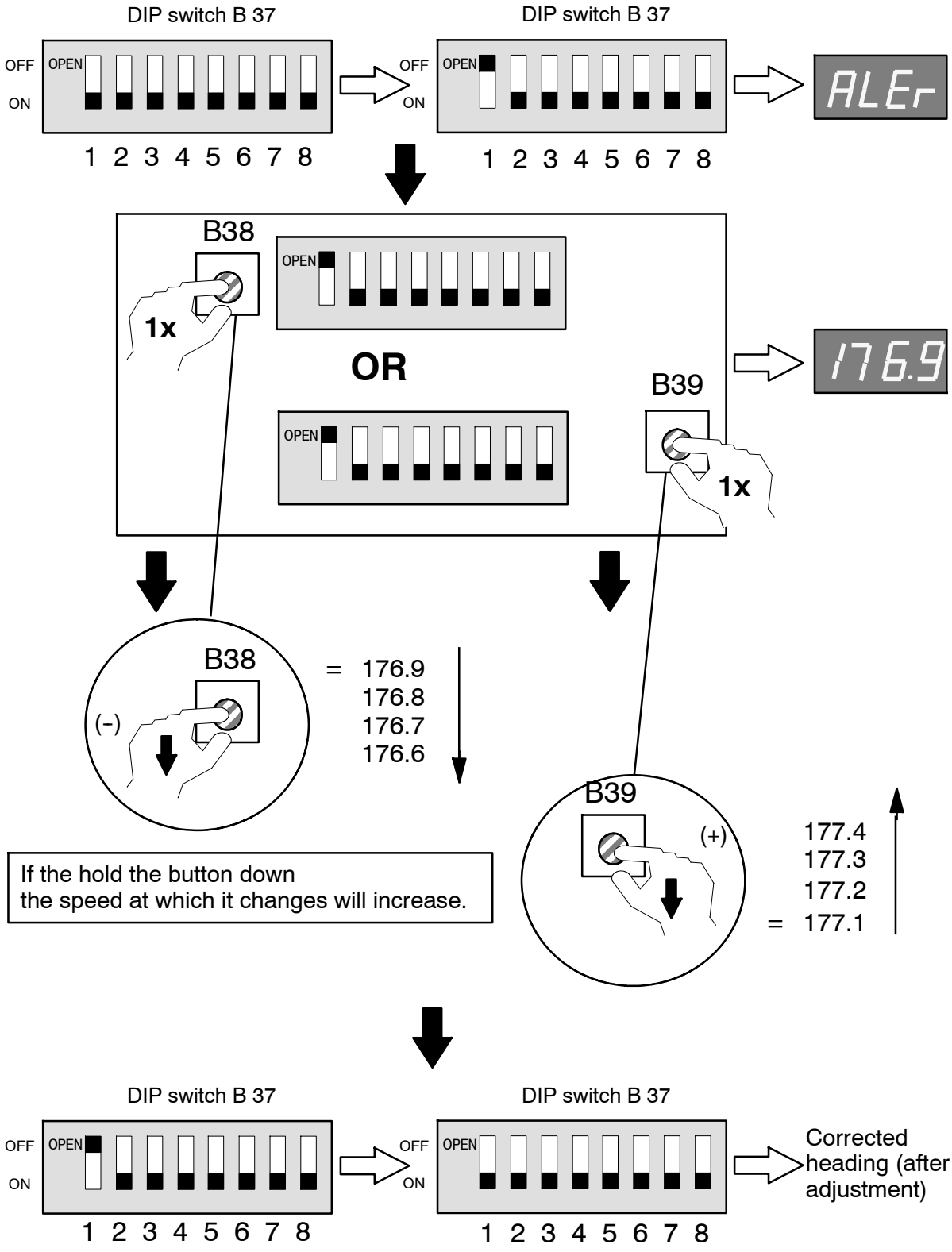


Figure 13: Procedure for setting compass zero

2.2.2 Speed error

A speed error occurs while the ship is travelling. This becomes greater as the speed increases and is more pronounced on northerly and southerly headings than on easterly and westerly headings.
Speed error is a physical deviation from the steering heading indicated on the gyro compass (compass heading) from the true heading (chart heading). It depends on the speed of the ship, the heading it is steering and the latitude.
The speed error is typically within the range of 0°–2°, and with fast ships, it can even reach 5°or more.
With automatic speed error correction the compass heading is continually corrected using the values shown in the speed error table (see section 2.2.2.1). The digital display on the compass and the connected repeater displays will always indicate the true (corrected) heading.
For automatic speed error correction the ship's speed and the latitude are read into the gyro compass.

<u>The speed error correction function on the STD22 Compact Gyro Compass</u>

Only the automatic speed error correction function applies; in order for it to operate GPS or Pulse Log and GPS data (speed and degree of latitude) must be supplied to the compass.

CAUTION: If the speed and latitude are not available for automatic speed error correction (Pulse Log or GPS failure), no automatic correction can take place. The gyro compass will be showing the uncorrected value.

<u>The speed error correction function on the STD22 Gyro Compass</u>

In this version, besides the automatic speed error correction function (with GPS and Log data) the speed error correction function can also be carried out (with manual speed and latitude values input) manually. The speed error can be corrected manually on the Operator unit by entering the speed and latitude manually (see also Manual of Operator Unit 130-626)

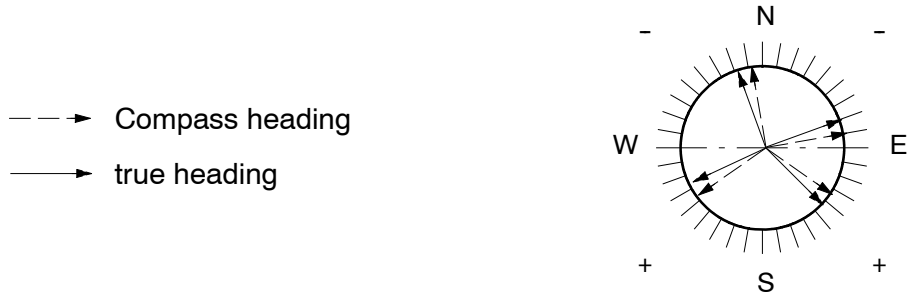
Add the correction value taken from the table to the uncorrected heading (making sure you note the leading sign).

Example of heading calculation	1	2
Compass heading	345°	223.7°
Latitude	55°	55°
Speed	16 Kts	16 Kts
Correction value from table	- 1.7°	+ 1.3°
True heading	345° - 1.7° = 343,3°	223.7° + 1.3° = 225°

Example of a bearing:

Compass heading	255°
Latitude:	55°
Speed:	16 Kts
Direction of bearing:	135°
Correction value as per table:	+0.5°
True bearing:	135° + 0.5° = 135.5°

The following statement applies:
The TRUE HEADING is always to the west of the compass heading.



2.2.2.1 Speed error table

Latitude in °	north		south		Speed in Kts										
	Headings in ° sign for correction value														
	-		+		4	8	12	16	20	24	28	32	36	40	44
0 to 20	0	360	180	180	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.1	2.4	2.6	2.9
	15	345	165	195	0.3	0.5	0.8	1.0	1.3	1.4	1.7	2.0	2.3	2.5	2.8
	30	330	150	210	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.8	2.0	2.3	2.5
	45	315	135	225	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1
	60	300	120	240	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.4
	75	285	105	255	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
30	0	360	180	180	0.3	0.6	0.9	1.2	1.5	1.7	2.0	2.3	2.6	2.9	3.2
	15	345	165	195	0.3	0.6	0.9	1.1	1.4	1.6	1.9	2.3	2.6	2.8	3.1
	30	330	150	210	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.3	2.5	2.8
	45	315	135	225	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.7	1.9	2.1	2.3
	60	300	120	240	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.5	1.6
	75	285	105	255	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
40	0	360	180	180	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7
	15	345	165	195	0.3	0.7	1.0	1.2	1.5	1.9	2.2	2.6	2.9	3.2	3.5
	30	330	150	210	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.6	2.9	3.2
	45	315	135	225	0.2	0.4	0.7	0.9	1.2	1.4	1.6	1.9	2.1	2.4	2.6
	60	300	120	240	0.2	0.3	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.7	1.8
	75	285	105	255	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
45	0	360	180	180	0.4	0.7	1.1	1.4	1.8	2.2	2.5	2.9	3.2	3.6	4.0
	15	345	165	195	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8
	30	330	150	210	0.3	0.6	0.9	1.2	1.6	1.9	2.2	2.5	2.8	3.1	3.4
	45	315	135	225	0.3	0.5	0.8	1.0	1.2	1.5	1.8	2.0	2.3	2.5	2.8
	60	300	120	240	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0
	75	285	105	255	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
50	0	360	180	180	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.3
	15	345	165	195	0.4	0.8	1.1	1.5	1.8	2.2	2.6	3.1	3.4	3.8	4.2
	30	330	150	210	0.3	0.7	1.0	1.3	1.6	2.0	2.3	2.7	3.1	3.4	3.8
	45	315	135	225	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.8	3.1
	60	300	120	240	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2
	75	285	105	255	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0

Latitude in °	north		south		Speed in Kts										
	Headings in ° sign for correction value														
	-		+		48	52	56	60	64	68	72				
0 to 20	0	360	180	180	3.1	3,4	3,7	3,9	4,2	4,4	4,9				
	15	345	165	195	3.0	3,3	3,5	3,8	4,0	4,3	4,7				
	30	330	150	210	2,7	3,0	3,2	3,4	3,6	3,8	4,2				
	45	315	135	225	2,2	2,4	2,6	2,8	3,0	3,1	4,3				
	60	300	120	240	1,6	1,7	1,8	2,0	2,1	2,2	2,4				
	75	285	105	255	0,8	0,9	1,0	1,0	1,1	1,2	1,3				
	90	270	90	270	0	0	0	0	0	0	0				
30	0	360	180	180	3,5	3,8	4,1	4,4	4,7	5,5	5,3				
	15	345	165	195	3,4	3,7	4,0	4,3	4,5	4,8	5,1				
	30	330	150	210	3,0	3,3	3,6	3,8	4,1	4,3	4,6				
	45	315	135	225	2,5	2,7	2,9	3,1	3,3	3,5	3,7				
	60	300	120	240	1,8	1,9	2,1	2,2	2,3	2,5	2,6				
	75	285	105	255	0,9	1,0	1,1	1,1	1,2	1,3	1,4				
	90	270	90	270	0	0	0	0	0	0	0				
40	0	360	180	180	4,0	4,3	4,6	5,0	5,3	5,6	6,0				
	15	345	165	195	3,8	4,2	4,5	4,8	5,1	5,5	5,8				
	30	330	150	210	3,5	3,7	4,0	4,3	4,6	4,9	5,2				
	45	315	135	225	2,8	3,1	3,3	3,5	3,6	4,0	4,2				
	60	300	120	240	2,0	2,2	2,3	2,5	2,7	2,8	3,0				
	75	285	105	255	1,0	1,1	1,2	1,3	1,4	1,5	1,5				
	90	270	90	270	0	0	0	0	0	0	0				
45	0	360	180	180	4,3	4,7	5,0	5,4	5,8	6,1	6,5				
	15	345	165	195	4,2	4,5	4,9	5,2	5,6	5,9	6,3				
	30	330	150	210	3,8	4,0	4,4	4,7	5,0	5,3	5,6				
	45	315	135	225	3,1	3,3	3,6	3,8	4,1	4,3	4,6				
	60	300	120	240	2,2	2,3	2,5	2,7	2,9	3,1	3,2				
	75	285	105	255	1,1	1,2	1,3	1,4	1,5	1,6	1,7				
	90	270	90	270	0	0	0	0	0	0	0				
50	0	360	180	180	4,8	5,1	5,5	5,9	6,3	6,7	7,1				
	15	345	165	195	4,6	5,0	5,4	5,7	6,1	6,5	6,9				
	30	330	150	210	4,1	4,5	4,8	5,1	5,5	5,8	6,2				
	45	315	135	225	3,4	3,6	3,9	4,2	4,5	4,8	5,0				
	60	300	120	240	2,4	2,6	2,8	3,0	3,2	3,4	3,6				
	75	285	105	255	1,2	1,3	1,4	1,5	1,6	1,7	1,8				
	90	270	90	270	0	0	0	0	0	0	0				

Latitude in °	north / south				Speed in Kts										
	Headings in ° sign for correction value														
	-		+		4	8	12	16	20	24	28	32	36	40	44
	0	360	180	180	0.4	0.9	1.3	1.8	2.2	2.7	3.1	3.6	4.0	4.4	4.9
	15	345	165	195	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4	3.9	4.3	4.7
	30	330	150	210	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.1	3.5	3.8	4.2
55	45	315	135	225	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.5
	60	300	120	240	0.2	0.4	0.7	0.9	1.1	1.3	1.6	1.8	2.0	2.2	2.4
	75	285	105	255	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6
	15	345	165	195	0.5	0.9	1.4	1.9	2.4	2.9	3.4	3.9	4.4	4.9	5.4
	30	330	150	210	0.4	0.8	1.3	1.7	2.1	2.6	3.1	3.5	4.0	4.4	4.9
60	45	315	135	225	0.4	0.7	1.1	1.4	1.8	2.2	2.5	2.9	3.2	3.6	4.0
	60	300	120	240	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8
	75	285	105	255	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.5
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.7
	15	345	165	195	0.6	1.2	1.7	2.3	2.9	3.5	4.1	4.7	5.2	5.8	6.4
	30	330	150	210	0.5	1.0	1.6	2.1	2.6	3.1	3.6	4.2	4.7	5.2	5.7
65	45	315	135	225	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4	3.8	4.3	4.7
	60	300	120	240	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3
	75	285	105	255	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.6	1.7
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.7	7.5	8.2
	15	345	165	195	0.7	1.4	2.2	2.9	3.6	4.3	5.0	5.8	6.5	7.2	7.9
	30	330	150	210	0.6	1.3	2.0	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1
70	45	315	135	225	0.5	1.1	1.6	2.1	2.6	3.2	3.7	4.2	4.7	5.3	5.8
	60	300	120	240	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1
	75	285	105	255	0.2	0.4	0.6	0.8	0.9	1.2	1.4	1.5	1.7	1.9	2.1
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	1.0	2.0	3.0	3.9	4.9	5.9	6.9	7.9	8.9	9.9	10.9
	15	345	165	195	0.9	1.9	2.9	3.8	4.8	5.7	6.7	7.6	8.6	9.5	10.5
	30	330	150	210	0.8	1.7	2.6	3.4	4.3	5.1	6.0	6.8	7.7	8.6	9.4
75	45	315	135	225	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	7.7
	60	300	120	240	0.5	1.0	1.5	2.0	2.5	3.0	3.4	3.9	4.4	4.9	5.4
	75	285	105	255	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0

Latitude in °	north		south		Speed in Kts										
	Headings in ° sign for correction value														
	-		+		48	52	56	60	64	68	72				
55	0	360	180	180	5,3	5,8	6,2	6,7	7,1	7,5	8,0				
	15	345	165	195	5,1	5,6	6,0	6,4	6,9	7,3	7,7				
	30	330	150	210	4,6	5,0	5,4	5,8	6,1	6,5	6,9				
	45	315	135	225	3,8	4,1	4,4	4,7	5,0	5,3	5,6				
	60	300	120	240	2,7	2,9	3,1	3,3	3,5	3,8	4,0				
	75	285	105	255	1,4	1,5	1,6	1,7	1,8	2,0	2,1				
	90	270	90	270	0	0	0	0	0	0	0				
60	0	360	180	180	6,1	6,6	7,1	7,6	8,2	8,7	9,2				
	15	345	165	195	5,9	6,4	6,9	7,4	7,9	8,4	8,9				
	30	330	150	210	5,3	5,7	6,2	6,6	7,1	7,5	7,9				
	45	315	135	225	4,3	4,7	5,0	5,4	5,8	6,1	6,5				
	60	300	120	240	3,0	3,3	3,6	3,8	4,1	4,3	4,6				
	75	285	105	255	1,6	1,7	1,8	2,0	2,1	2,2	2,4				
	90	270	90	270	0	0	0	0	0	0	0				
65	0	360	180	180	7,2	7,8	8,4	9,1	9,7	10,3	10,9				
	15	345	165	195	7,0	7,6	8,2	8,7	9,3	9,9	10,5				
	30	330	150	210	6,3	6,8	7,3	7,8	8,4	8,8	9,4				
	45	315	135	225	5,1	5,5	6,0	6,4	6,8	7,2	7,7				
	60	300	120	240	3,6	3,9	4,2	4,5	4,8	5,1	5,4				
	75	285	105	255	1,9	2,0	2,2	2,3	2,5	2,6	2,8				
	90	270	90	270	0	0	0	0	0	0	0				
70	0	360	180	180	8,9	9,7	10,5	11,2	12,0	12,7	13,5				
	15	345	165	195	8,6	9,4	10,1	10,8	11,6	12,3	13,0				
	30	330	150	210	7,7	8,4	9,0	9,7	10,3	11,0	11,7				
	45	315	135	225	6,3	6,8	7,4	7,9	8,4	9,0	9,5				
	60	300	120	240	4,5	4,8	5,2	5,6	6,0	6,3	6,7				
	75	285	105	255	2,3	2,5	2,7	2,9	3,1	3,3	3,5				
	90	270	90	270	0	0	0	0	0	0	0				
75	0	360	180	180	11,9	12,9	13,9	14,9	15,9	16,9	17,9				
	15	345	165	195	11,4	12,4	13,4	14,4	15,3	16,3	17,3				
	30	330	150	210	10,2	11,1	12,0	12,9	13,7	14,6	15,5				
	45	315	135	225	8,4	9,1	9,8	10,5	11,2	11,9	12,6				
	60	300	120	240	5,9	6,4	6,9	7,4	7,9	8,4	8,9				
	75	285	105	255	3,1	3,3	3,6	3,8	4,1	4,3	4,6				
	90	270	90	270	0	0	0	0	0	0	0				

3 Operating conditions requiring attention

An operating condition that indicates a malfunction but has no immediate effect on the heading output is indicated by a flashing decimal point.

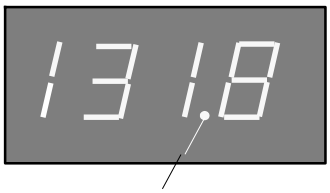
It is not necessary to acknowledge such a condition on the compass.

The flashing decimal point remains until the malfunction has been corrected.

The heading indicated on the digital display unit is not affected.

EXCEPT for “Voltage cut-off” (see section 3.1)

The flashing decimal point remains until the malfunction has been corrected.



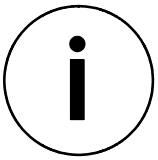
Decimal point (flashes)
on the digital display unit

Please pay special attention when the compass housing is opened.

Risk of electric shock!

In opened devices voltages representing a risk of electric shock are applied.

Please note that the compass does not meet its specified environmental requirements such as Internal Protection (IP), electromagnetic compatibility (EMC) and vibration with an opened housing.



A flashing decimal point in the seven segment display indicates an operating condition where the operation of the gyro equipment is not restricted. The operating condition needs to be checked. Call an authorized service station if required.

3.1 Operating conditions requiring attention, their causes, and what to do

There are five different operating conditions requiring attention (numbered 1 to 6, 6 is not used).
These are displayed on the compass's digital display after the B38 or B39 buttons have been pressed once.
1 to 3 are displayed when button B39 is pressed, and 4–6 are displayed when button B38 is pressed.
If several conditions occur at the same time all are displayed.

The following operating conditions can be displayed:

1 = fan failure
2 = heater failure
3 = supporting liquid temperature is higher than 60°C

} Button B39

4 = supporting liquid level is too low
5 = after voltage cut-off
6 = not used

} Button B38

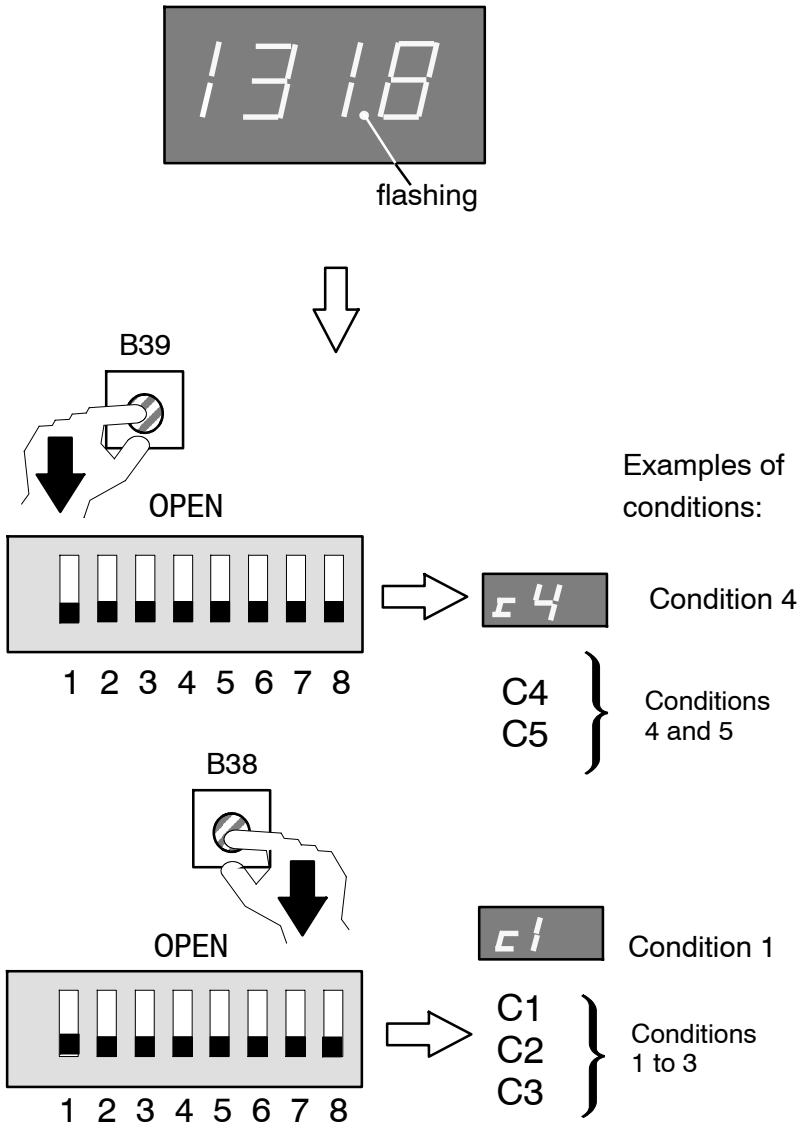


Figure 14 : How to display information about operating conditions

3.1.1 Operating condition 1 “Fan failure”

This condition is generated if the fan does not switch itself on as a result of the temperature of the supporting liquid (it should switch on when the supporting liquid reaches 51°C).
Whether the fan is operational or not is registered from the fan’s current consumption; it therefore follows that the fan is defective if this condition is displayed.
To prevent overheating due to fan failure, it is recommended that you do the following:

- Check whether the fan screen is covered and check to see that air can enter the enclosure unhindered at the base.
- If necessary cool the outer sphere using an external fan.

Continue this until operating condition 1 stops.

It is essential that the fan be replaced at the earliest opportunity.

NOTE: A critical situation occurs, if the ambient temperature is extremely high and condition 3 is displayed “Temperature of supporting liquid more than 60°C”. Constant high temperature may effects to the life cycle of the gyro compass. A higher temperature for a short moment has no importance.

3.1.2 Operating condition 2 “Heater failure”

This condition is output when the heater (≥45°C) has failed.

Compass operation is not restricted if the temperature is more than 45°C (see also “fan failure”.

A temperature drop down below 45°C leads to an error message “Error” and the heading information will not longer displayed (as well as the heading information to the connected heading receivers).

To prevent the supporting liquid from cooling further, it is recommended that to do the following:

- Close the door on the compass, or
- introduce warm air.

These measures should be continued until condition 2 stops.

It is essential that the heater be repaired at the earliest opportunity.

3.1.3 Operating condition 3 “Supporting liquid > 60°C.”

This condition is output when the temperature of the supporting liquid is higher than 60°C.

To prevent the temperature from rising further, it is recommended that you do the following:

- Open the door on the compass
- If necessary cool the outer sphere using an external fan.
- Check the ambient temperature. If the ambient temperature is higher than 60°C steps should be taken to cool it down.

These measures should be continued until condition 3 stops.

If condition 3 is displayed in combination with condition 1, the fan must be replaced at the earliest opportunity.

See also condition “fan failure”.

3.1.4 Operating condition 4 “Supporting liquid level too low” and its immediate measure

This condition is output when the level of the supporting liquid in the outer sphere is too low. The supporting liquid level is determined by an immersion probe installed in the upper part of the outer sphere.

There are two ways to check the supporting liquid and to fill-in supporting liquid/distilled water.
The first (section 3.1.4.1) has to be performed by switching off the gyro compass.
The second (section 3.1.4.2) can be performed without switching off the gyro compass, but it must be performed very carefully and ideally under calm sea conditions.

3.1.4.1 With switching off the gyro compass

The measure below does not compensate the planned replacement of the supporting liquid!

In certain circumstances (if the level of the supporting liquid falls suddenly) you must establish the cause (possibly a leak) and correct the fault.

If the level of supporting liquid is too low, the compass can be destroyed.

Immediate measure

Caution!
It is strongly recommended to perform a service within the next 6 months to check the compass.

Caution!
This measure is an exception to restore operation.

Caution!
Due to condition “4”, we advice to arrange a service for a routine check during the next port stay to be on safe side.

- Switch off the compass and wait approx. 15 minutes (otherwise the gyrosphere can be damaged).
- Open the door of the compass housing, paying attention to the earthing strip.
- Place both hands under 2 of the 4 snap closures and release them by pressing with the thumbs.
- Remove all connections/cables that lead to the outer sphere and note their location.
- Carefully turn the outer sphere through 90° and repeat the process with the other two snap closures. The outer sphere is now free and can be removed.
- Still holding the outer sphere with both hands, lower it slightly (this releases the locking device), carefully remove it from the compass enclosure and set it down.
- Open the ventilation outlet (Figure 15 /1), the supporting liquid screw (Figure 15 /3) and the distilled water screw (Figure 15 /2).
- Fill in distilled water (**only** distilled water from Raytheon Anschütz, part number 148-398, one 230cm^3 bottle) into the inlet for supporting liquid until the measuring cone shows “Level O.K.”, see Figure 16 .
- Fill in the remaining content of the bottle into the inlet for distilled water until the Dip-Stick shows a level according to Figure 17 .
- Close all in- and outlets, if applicable use new sealing rings.
- Place the outer sphere in the compass enclosure.

- Pay attention to the two locking pins on the closure.

- Hold the outer sphere with both hands and guide it under the snap closures on the pendulum joint.
- Using the thumbs, press down and engage the two snap closures.
- Carefully turn the outer sphere through 90° and repeat the process with the other two snap closures. The outer sphere is now fastened to the pendulum joint.
- Fix all connections/cables that lead to the outer sphere as notes before.
- Close the door of the enclosure and fasten it with screws, paying attention to the earthing strip.
- When the power supply is switched on, the compass is ready for use again. Run the heating and settling in stages as described in section 2.1.

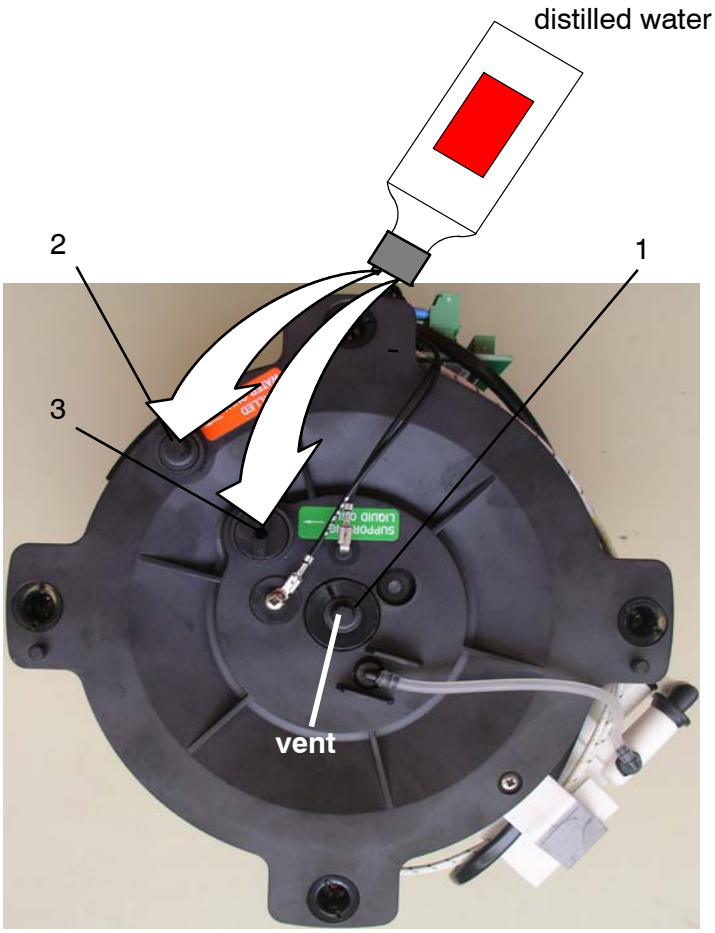
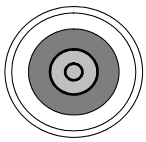
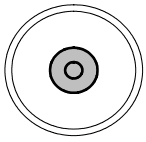


Figure 15 : Immediate measure to fill up with distilled water



Level: OK
(at operational temperature (appr. 50° C))



Level: too low

Figure 16 : Measuring cone (top view)

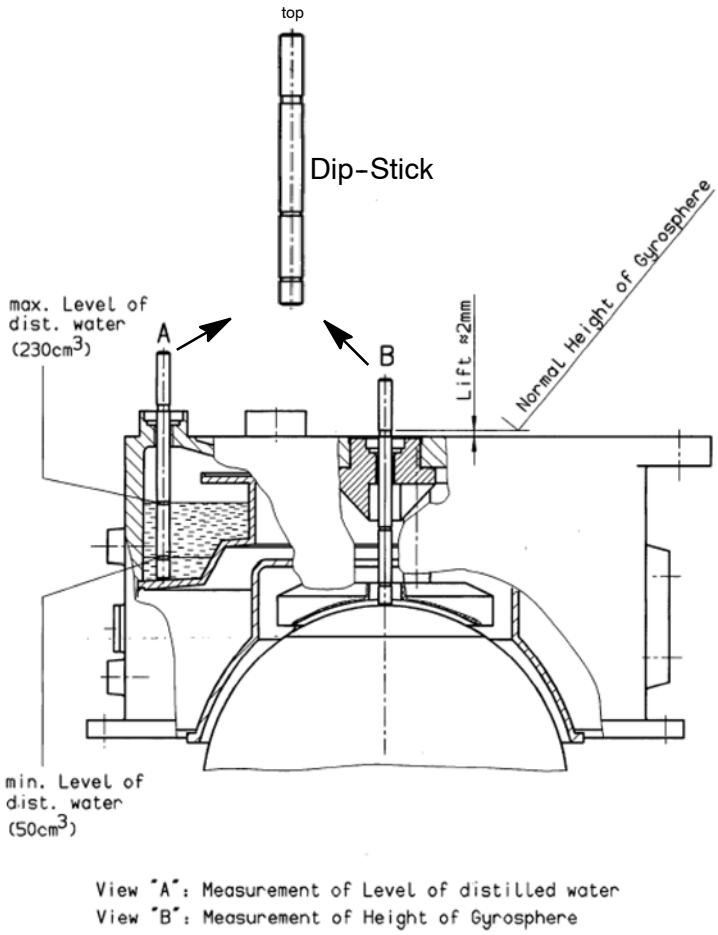


Figure 17 : Dip-Stick levels

3.1.4.2 Without switching off the gyro compass

The measure below does not compensate the planned replacement of the supporting liquid!
In certain circumstances (if the level of the supporting liquid falls suddenly) you must establish the cause (possibly a leak) and correct the fault.
If the level of supporting liquid is too low, the compass can be destroyed.

Immediate measure

Caution!
It is strongly recommended to perform a service within the next 6 months to check the compass.

Caution!
This measure is an exception to restore operation.

Caution!
Due to condition “4”, we advice to arrange a service for a routine check during the next port stay to be on safe side.

Caution!
This measurement must be performed very carefully and ideally under calm sea conditions.

It is not necessary to switch off the gyro compass for this measurement.

- Undo the two screws at the top and the bottom of the door of the gyro compass enclosure and lift out the door, paying attention to the earthing strip.
- Switch off the follow-up function (see Figure 18).
  This must be done to prevent a twisting of connected cables (no plugs must be disconnected).

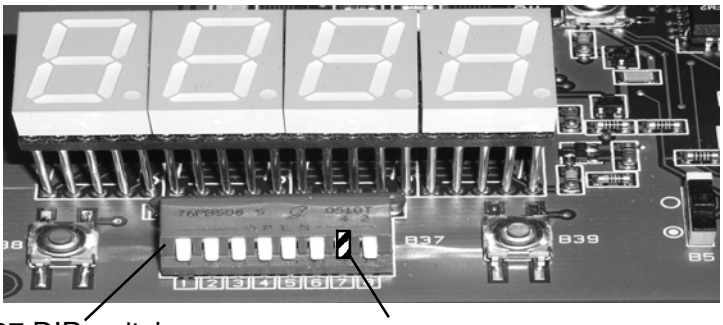


Figure 18 : Arrangement of DIP switch

- Set DIP switch 7 into the upper position (the follow-up function is stopped)
- Place both hands under 2 of the 4 snap closures and release them by pressing with the thumbs.
- Carefully turn the outer sphere through 90° and repeat the process with the other two snap closures. The outer sphere is now free (except connected cables) and can be removed.
- Still holding the outer sphere with both hands, lower it tightly (This releases the locking device), carefully remove it out of the compass enclosure (as far as the cable length)and set it down.

Caution!
Handling of the outer sphere should be performed to the greatest possible extent in a horizontal position.

- Open the ventilation outlet (Figure 15 /1), the supporting liquid screw (Figure 15 /3) and the distilled water screw (Figure 15 /2).
- Fill in distilled water (**only** distilled water from Raytheon Anschütz, part number 148-398, one 230cm^3 bottle) into the inlet for supporting liquid until the measuring cone shows “Level O.K.”, see Figure 16 .
- Fill in the remaining content of the bottle into the inlet for distilled water until the Dip-Stick shows a level according to Figure 17 .
- Close all in- and outlets, if applicable use new sealing rings.
- Place the outer sphere in the compass enclosure.

- Pay attention to the two locking pins on the closure.

- Hold the outer sphere with both hands and guide it under the snap closures on the pendulum joint.
- Using the thumbs, press down and engage the two snap closures.
- Carefully turn the outer sphere through 90° and repeat the process with the other two snap closures. The outer sphere is now fastened to the pendulum joint.
- Switch on the follow-up function again (DIP switch 7 into the lower position, see Figure 18).
- Close the door of the enclosure and fasten it with screws, paying attention to the earthing strip.

After this procedure is finished, it is strongly recommended to observe the heading for a while (30 minutes), because of stimulation of the gyrosphere (caused by a slight, unintentional horizontal inclination).

3.1.5 Operating condition “Voltage cut-off”

This operating condition is output if the supply voltage is cut off for a short time. The cut-off period is determined by the fall in supporting liquid temperature. If the temperature falls below 45°C the compass recognises that the voltage supply has been switched off in the conventional way.

In the case of a voltage cut-off (supporting liquid temperature does not fall to below 45°C) and the voltage supply has been restored, the settling stage in indicated again (see also section 2.1.1 “Compass indications during the settling stage”).

Note: Heading indication can be incorrect. Wait for a complete follow up,
Check voltage supply to the gyro compass!

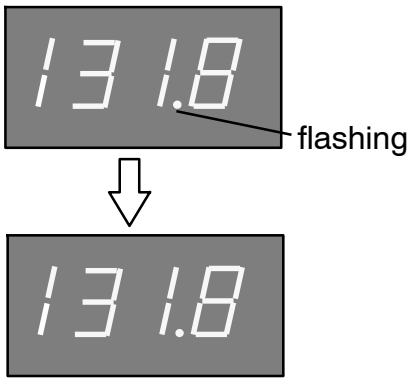


Figure 19 : Digital display for “Voltage cut-off”

If voltage cut-offs occur often, the following checks should be made:

- check the on-board power supply
  or
- check the the on-board power supply ⇒ distribution unit ⇒ compass cable connections
  or
- check the the on-board power supply ⇒ AC/DC converter ⇒ compass cable connections

4 Alert signalling

Alerts are indicated on the compass as follows:

The heading is not displayed and not output to the connected heading receivers!

An alert signal is indicated on the digital display by means of a flashing Erro (for Error) (flashing “OFF”), flashing “OFF” occurs only when the voltage is too low.

After the blinking “Erro” the compass internal PC-board which fails and an error code is displayed (detailed information -> see Service manual).

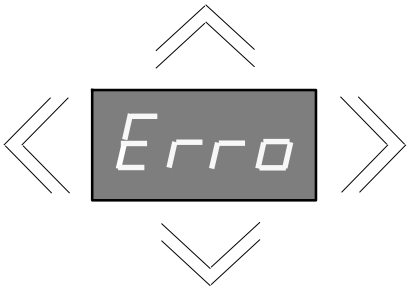


Figure 20 : Digital display for “error indication”

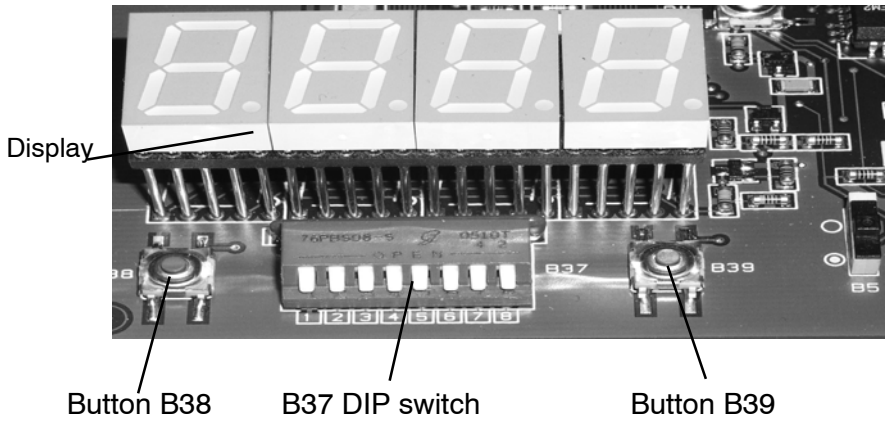


Figure 21 :Operating elements on the compass (after removing the cover)

The following failed PC-boards are possible:

PCbP = power PCB faulty

PCbS = sensor PCB faulty

PCBC = connection PCB faulty

PCbG = outer sphere PCB faulty

See the service manual for more details.

Error group	Comment	Error-code
PCbP	Serial connection of sensor PCB to power PCB faulty	E.L.01
PCbP	Inductive transmission faulty	E.L.02
PCbP	System voltage (B5.5 ⇒ B5.8) on power PCB faulty	E.L.03
PCbP	Encoder voltage faulty	E.L.04
PCbP	System voltage (B5.1 ⇒ B5.4) on power PCB faulty	E.L.05
PCbS	Encoder faulty	E.L.06
PCbS	CAN dialogue from gyro card to sensor PCB faulty	E.L.07
PCbS	Follow-up system faulty	E.L.08
PCbC	CAN1 and CAN2 operating voltage faulty	E.L.09
PCbG	Supporting liquid error	E.L.10
PCbG	System voltage (B21.5 ⇒ B21.8) on outer sphere PCB faulty	E.L.11
PCbG	Operating voltage 24V faulty	E.L.12
PCbG	Operating voltage 15V faulty	E.L.13
PCbG	Heating operating voltage (B21.1 ⇒ B21.4) faulty	E.L.14
PCbG	Operating voltage 72V faulty	E.L.15
PCbG	Operating voltage 78V faulty for 400 Hz	E.L.16
PCbG	Gyro supply $55V_{eff}$ faulty	E.L.17
PCbG	Gyro current faulty	E.L.18
PCbG	Pump voltage faulty	E.L.19
PCbG	Pump current faulty	E.L.20
PCbG	Temperature sensor faulty	E.L.21
PCbG	Serial interface MC1 to MC2 faulty	E.L.22
PCbG	CAN interface from sensor PCB to outer sphere PCB faulty	E.L.23
PCbG	Heating system faulty	E.L.24
Status	Watchdog counter	E.L.25
Status	Power-ON counter	E.L.26
Status	OFF-status counter	E.L.27
Operating condition	Fan failure	C.L.1
Operating condition	Heater failure	C.L.2
Operating condition	Supporting liquid > 60°C	C.L.3
Operating condition	Supporting liquid too low	C.L.4
Operating condition	Voltage cut-off	C.L.5

5 Switching off the Gyro Compass

The gyro compass is switched off by switching off the power supply.

Caution!

- Maintenance and repair work should be carried out only by trained and qualified staff who are well versed in national safety regulations.
- After the gyro compass has been switched off it is necessary to wait at least 15 minutes before accessing the interior of the gyro compass.
  Otherwise the gyro system could be damaged!

6 Maintenance

Supporting liquid, distilled water and Pump Rotor have to be replaced every 18 – 24 months. It is additionally recommended to clean the internal of the outer sphere and the gyro compass.

Instructions for carrying out this operation and a maintenance plan (for authorized service personnel only) are given in the service manual.

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